Section: Miscellaneous

Original Research Article

EFFECT OF DIABETES MELLITUS ON PULMONARY FUNCTION TESTS IN A TRIBAL POPULATION OF SOURTHERN ODISHA

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ABSTRACT

Diabetes Mellitus is a metabolic disorder affecting almost all the organs of the body. Study has been done to find out the association of diabetes with many disorders like as retinopathy, nephropathy, neuropathy, cardio vascular, and peripheral vascular diseases but very less number of studies are done on effect of diabetes on Lung Functions. The present study was done keeping that in view in a medical college and hospital located in Sourthern Odisha, a state in India. Material & Method- The study was done on 40 male tribal patients suffering from Type 2 Diabetes Mellitus(T2DM) whose Pulmonary Function Tests(PFT) were done and were compared with 40 normal male taken as control who were age, height and weight matched from the same tribal community. Result- It was seen that the PFT parameters of Case group with diabetes patients were significantly reduced in comparison to healthy control. Conclusion- Diabetes can lead to pulmonary complications, mainly restrictive type.

Keywords: Diabetes Mellitus, Pulmonary Function Tests.

INTRODUCTION

The syndrome caused by deficiency of insulin is call diabetes mellitus.[1] Diabetes mellitus is a metabolic disorder with harmful effects on several body systems. Complications include micro vascular and macro vascular conditions, such as retinopathy, nephropathy, neuropathy, cardio vascular, and peripheral vascular diseases.[2] Due to the complications, Diabetes is associated with increased morbidity and mortality. Hence, involvement of any other organ is now the main focus. In diabetes, there is micro & macrovascular disorder which produce debilitating effects on various organs. The alveolar capillary network in the lung is a large micro vascular unit and may be affected by microangiopathy.[3] The effect of diabetes on lung functions has not been well studied in patients. A studyby VAN DEN BORST et al. showed an association between Type 2 Diabetes Mellitus (T2DM) and a restrictive pattern of lung disease.[4] The lung was targeted in diabetic microangiopathy, histo pathology showed basal lamina thickening and fibrosis.[5] The lung contains many micro-vascular circulations and connective tissues that raises the possibility of lung being affected by microangiopathic process and non-enzymatic glycosylation of tissue proteins, caused by chronic hyperglycaemia.[6] The normal lung mechanics and gas exchange are influenced by the integrity of pulmonary connective tissue and microvasculature, so any abnormalities in either of the two structural components lead to abnormal pulmonary function tests (PFT).[7] Diabetes mellitus is associated with increased levels of systemic inflammatory mediators and inflammatory markers which together with microangiopathy are accused in alterations of lung matrix proteins and hence the impairment of pulmonary functions8. Several studies have been conducted to assess the hazardous effects of T2DM on pulmonary functions, still nothing has been strongly established till now. The related literature in India is also limited. Hence, this study was conducted to determine the effect of Type 2 DM on pulmonary function tests in the tribal people living in Sourthern odisha.

The aim of the study is to find out the PFTs in type 2 DM patients and compare them with the age and gender matched healthy controls. A correlation is also done of the HbA1C level and duration of the diabetes with PFTs in type 2 DM patients.

MATERIALS AND METHODS

The study was Case-Control study done in Department of Physiology, SLN MCH, Koraput after receiving Institutional Ethical Committee approval No.- 11/22/IEC, SLNMCH, Koraput, Dated-04/04/2022. 40 tribal patients of a village with T2DM were selected and 40 normal people from the same tribal population were taken. The study was done between 18/04/2022 to 22/7/2023.

Inclusion Criteria

1. Patients of same tribal community of one village.
2. Patient with Type 2 Diabetes Mellitus only.
3. Normal population from same tribal community from the same village.

Exclusion Criteria:

Those with acute or chronic lung diseases, cardiovascular diseases, history of occupational exposure or a history of smoking, any physical disability that may affect lung function(restriction). We have not considered obese persons (BMI > 30 kg/m2).

Fasting, postprandial blood glucose and HbA1C levels were measured to rule out type 2 DM in them. Biochemical investigations: Blood samples were obtained after a 8 h overnight fast for the estimation of levels of blood glucose and repeated two hours post prandially. The Control Groups were checked for Impaired Fasting Glycemia(IFG), Impaired glucose tolerance(IGT) and diabetes. We have taken Fasting blood glucose of 126 mg/dL, >110 mg/dL & <126 mg/dl and 2 h blood glucose post 75 g of glucose of P140 mg/dL & <200 mg/dl to define diabetes, IFG and IGT respectively. Control subjects with a normal fasting blood glucose of <110 mg/dl and 2 hour post prandial glucose of <140 mg/dl were included into the study.[9]

HbA1c was used as an level of glucose over the last 3 months. Level above 7.5% were considered as poor glycemic control and lower than it was considered as good glycemic control.[10] We have recorded the height and weight of all subjects. BMI was calculated.

We have used RMS Helios 401 computerized spirometer (Recorders & Medicare Systems Pvt Ltd (RMS), India) to record the pulmonary function test of the Case Group and Control Group.[11,12] Control and diabetic subjects performed the maneuver three times at the interval of 10 minutes, and the best of the three was taken for analysis. Parameters assessed were - forced vital capacity (FVC) in liters, forced expiratory volume in 1 second (FEV1), FEV1/FVC in percentage (%), forced expiratory flow during 25-75% of FVC (FEF25-75), PEFR and the maximum ventilatory volume (MVV). We have taken the percentage of the predicted values for all these parameters as per the height, age and weight.

Statistical analysis was done by SPSS software. Unpaired t-Test was used to compare the data in both the group. P <0.05 was taken as statistical significant.

RESULTS

Table 1: Anthropometric measurements

	Case	Control	p
Age	59.66 ± 7.82	56.47 ± 10.36	0.1242 (>0.05)
Height (m)	161.28 ± 21.72	156.23 ± 17.55	0.2562 (>0.05)
Weight (kg)	69.43 ± 11.27	66.70 ± 13.51	0.3294 (>0.05)
BMI (Kg/m^2)	28.2 ± 0.6	27.8 ± 0.8	0.0134 (<0.05)
HbA1C	7.23 ± 0.05	5.84 ± 0.07	<0.0001 (<0.05)
Duration of T2DM	Between 5-10 yrs- 13 >10 yrs- 27	Nil	

Table 2: PFT parameters

	Case	Control	p
FVC	74.51 ± 10.09	82.12 ± 11.71	0.0026 (<0.05)
FEV1	76.73 ± 11.41	83.2 ± 13.61	0.0239 (<0.05)
FEV1/FVC	104.85 ± 11.18	107.44 ± 12.36	0.3287 (>0.05)
FEF (25-75)	70.04 ± 15.08	76.23 ± 12.26	0.0437 (<0.05)
PEFR	69.36 ± 16.35	81.7 ± 13.41	0.0004 (<0.05)
MVV	76.44 ± 17.14	89.01 ± 19.39	0.0029 (<0.05)

DISCUSSION

To our knowledge, this is the first study to demonstrate the relationship between T2DM and PFT in tribal people of this region. This study is also first in our state. Our study showed that all the pulmonary parameters, that is, FVC, FEV1, FEF25,7 PEFR and MVV were significantly reduced except FEV1 /FVC in patients of type 2 DM as compared with the healthy controls. In some studies it has shown that restrictive pattern of lung impairment in Type 2 DM13. Some of the authors showed that patients with Type 2 DM were frequently affected with several pulmonary diseases

like – pneumonia, Chronic Obstructive Pulmonary Disease (COPD) and asthma.[14] The collagen and elastin proteins are the main components of thorax and lungs. Nonenzymatic glycosytion of parenchymal structural compounds leads to stiffening of thorax and lung which may lead to restrictive pattern of abnormality.[3] Studies conducted by Gautam et al and Shah et al, showed that mean values of FVC, FEV1, and FEF25-75%, were significantly reduced in patients of type 2 DM.[15,16] Additionally, Keerthi et al also mentioned the reduction in MVV values in diabetic subjects.[17]

CONCLUSION

Diabetes Mellitus being a multi system affecting disease, also affects the lungs. Due to glycosylated changes in connective tissue of parenchyma, reduced pulmonary elastic recoil and inflammatory changes in lungs, a restrictive pattern of disease occurs in patients with prolonged diabetes. The tribal people of this area, even though they work hard and walk for long distance, still diabetes has reduced their PFT values.

Conflict of interest: None.

REFERENCES

1. M Kaur, S Nagpal. Text book of Physiology, Concepts with clinical insights. Complimentary Copy, 1st Edn, 2025, Pg.619.
2. Nathan DM. Diabetes: advances in diagnosis and treatment. JAMA. 2015; 314:1052–62.
3. Sandler M. Is the lung is target organ in diabetes mellitus? Arch Intern Med 1990; 150:1385 8.
4. Van den Borst B, Gosker HR, Zeegers MP, et al. Pulmonary function in diabetes. A metaanalysis. Chest 2010; 138: 393–406.
5. A.D. Falah, Spirometric changes in patients with diabetes mellitus, Med. J. Babylon 8 (2) (2011) 1–10.
6. M. Marvisi, L. Bartolini, P. Del Borello, Pulmonary function in non-insulin-dependent diabetes mellitus, Respiration 68 (2001) 268–272.
7. D.H. Kanya Kumari, S.M. Nataraj, H.S. Devaraj, Correlation of duration of diabetes and pulmonary function tests in type 2 diabetes mellitus patients, Int. J. Biol. Med. Res. 2 (4) (2011) 1168–1170.
8. J. Dennis, Dario. Maldonado, Maria X. Rojas, Pablo Aschner, Martin Rondon, Laura. Charry, Alejandro Casas, Inadequate glucose control in type 2 diabetes is associated with impaired lung function and systemic inflammation: a cross-sectional study, BMC Pulm. Med. 10 (2010) 38.
9. O.B. Ozoh, N.U. Okubabejo, E.O. Bandele, C.C. Chukwu. Ventilatory function in Nigerians with type 2 diabetes, African J. Resp. Med. (2010) 18–22.
10. P.J. Watkins, P.L. Drury, S.L. Howell. Diabetes and its Management, Blackwell Science Ltd, London, 1996, pp. 143 218.
11. Miller MR, Hankinson J, Brusasco V, et al.: Standardisation of spirometry. Eur Respir J. 2005, 26:319-38. 10.1183/09031936.05.00034805.
12. Mittal S, Jindal M, Srivastava S, Garg A: Duration of type 2 diabetes mellitus and pulmonary function tests: a correlative study. Int J Diabetes Dev Ctries. 2020, 40:114-18. 10.1007/s13410-019-00759-6
13. Engstrom GJ, Janzon L. Risk of developing diabetes is inversely related to lung function: A population based cohort study. Diabet Med 2002; 19:167 70.
14. Ehrlich SF, Quesenberry CP, Vanden Eeden SK, Shan J, Ferrara A. Patients diagnosed with diabetes are at increased risk for asthma, COPD, pulmonary fibrosis and pneumonia but not lung cancer. Diabetes Care 2010; 33:55 60.
15. Gautam, Piyush; Faraz, Ahmad; Ashraf, Hamid1; Singhal, Sangeeta. Diabetic Neuropathy, a Cause of Pulmonary Dysfunction in Patients of Type 2 Diabetes Mellitus: A Prospective Cross-Sectional Study. Bangladesh Journal of Endocrinology and Metabolism 2(1):p 35-40, Jan–Apr 2023. | DOI: 10.4103/bjem.bjem_15_22
16. Shah, Swati H.; Sonawane, Pranali; Nahar, Pradeep; Vaidya, Savita; Salvi, Sundeep1. Pulmonary function tests in type 2 diabetes mellitus and their association with glycemic control and duration of the disease. Lung India 30(2):p 108-112, Apr–Jun 2013. | DOI: 10.4103/0970-2113.110417.
17. SG Keerthi, Singh SB, B. HK Bandi, Suresh M, Preetham JK, Mallikarjuna RN: Deterioration of pulmonary functions in type 2 diabetes mellitus. J Pharm Biol Sci. 2012, 1: 39-43.